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genetic. To become inherited, a modification must produce changes in the energy of the germ plasm. All comparisons between diverse mechanisms are inexact analogies, but in most phylogenetic research we must base upon these. The unit of comparison is the whole individual during its life history and not any selected stage of it. The author inclines very strongly to Hatschek's trochophore theory, viz., that the free larvæ of marine annelids show uniformity of structure and these are all modifications of one kind. The earlier the modifications appear the more apt they are to be inherited. If the free swimming larvæ were a repetition of an ancestral adult condition, why should it not be equally conserved in marine and fresh water life?

Die Ameise, von K. ESCHERICH. Vieweg & Sohn, Braunschweig, 1906. pp. 232.

The author has here gathered the main results of the studies of nearly half a century and presented them in a systematic, critical way with 68 illustrations. The one great family of formicidæ comprises over five thousand species, sub-species and varieties. There are 170 genera and 5 great sub-families. There are enormous variations. The distribution of ants is almost worldwide between the polar circles. Although their optimal habitat seems to be the tropics, they have sometimes transcended both the Antarctic and the Arctic circle. They have a very common trait of founding states or colonies and the sterile female is greatly in evidence in all the species. While ants are no miniature men, they are no mere reflex automata, but have the psychic qualities of memory, association, perception, utilization of individual sense experience, and thus power of individual plastic adaptation. The latter is most pronounced among the workers, less with the queens and is almost undeveloped in the males. This difference has a very marked reflection in the structure of the brain which differs very much, the gray matter being far more developed in the workers. Something is known of their phylogeny. They long antedated man. Our author thinks that the first ants were winged and that they very slowly lost this trait, but that some species have reverted to wings, remarkable as this is. He also assumes that polymorphism had a slow development and is largely tropogenic. Wasmann has shown that the appearance of pseudogynes has a casual relation with the presence of certain guests of ants. These lived with them first in the symphilia. They were first received, they grew up in the nests and last the ants cared for them. These later destroyed the eggs and larvæ of their hosts. When the first workers appeared, there was, of course, an important change in the habits of these ants. Another phyletic trait is the slow development of the *Pilzgarten*. The writer believes that we can trace pretty directly the development of every stage of this process. He also has something to suggest about the instinct of feigning death, but the most important phyletic contribution is the writer's theory of eight stages in the development of the colonies, illustrated by as many different species. In this way he accounts for slavery, domestication and the development of mixed colonies. He deems that his results are borne out by the experiments of mixing species. On the whole this must be called quite a masterly compend.

Die Mimik des Denkes. Von DE SANCTIS. Halle, 1906.

De Sanctis reminds us that the reflexes, pulse, respiration, the pupil, respond with exquisite sensitiveness to psychic states. Thought mimesis comprises first that of sensory attention and second more intellectual inner reflection. The apparatus chiefly involved is the seventh pair of facial nerves, the root of which arises between the

pons and the medulla. Whether a cortical or bulbar origin is manifold or simple, probably neither Mendel's view that it is bulbar nor that of Monakow or Wildebrand that it is central should be neglected. Usually both are synergetically associated. Where the mimicry is purely voluntary the impulse probably originates from the psychomotor cortex. In childhood and in old age or in agenesis this is not developed. Animals differentiate their mimetic movements far less than man and their mimesis of attention has less emotional reinforcement. The higher animals have no proper centre for attentive mimesis. It may be in the ears or in the mouth. Sometimes it is a general irradiation and the whole body is motionless or tense, but with animals as soon as the tension becomes great it takes on an emotional character and spreads to the whole body, showing that attention is but little developed and that intellectual activity is not canalized in paralyzed nerve excitability. In old age mimic innervation loses the power to express transient effects by sufficient complementary movements, but only expresses the fundamental results in grosser movements. Old men in thinking are hypomimetic in comparison with children. Art shows the same thing.

In adults, thought mimesis is well differentiated from that of emotion, and in those accustomed to think, this difference stands out yet more clearly. In a certain sense this mimesis of thought in adults has its own organ, viz., the attentive mimic centre in the upper half of the face. This is often unsymmetrical. Its intensity is usually weak in brain workers, especially in those who have to tense the eyes its vigor is greater; in those who cannot read it is less. A very common irradiation is the mouth, but the individual variations are very great as is the toning of the effective elements. Very often we find positive anomalies which are hard to explain. They may extend not only to the back but to the limbs, head and the whole body. The mimesis of the sensory and inner attention is chiefly optical. Even the other senses express themselves in the visual sphere.

The mimesis of concentrated differs very much from that of diffuse thought. In the former the gestures and attitudes arise in the periphery and converge to the centre, especially the eye, as in the meditative type. Often the lower half of the face is hypertonic. This rigidity often distinguishes meditation from sleep. The muscles of the forehead are closely drawn together. The different types may vary according to the object, the habits of the subject or the degree of concentration. Some concentrations have a happy and some a sad nuance. The Japanese gods meditate with a smile. Philosophic thought is more often sad. The mystic illumination and unification are rapt as the writer shows by many quotations. The eyes may be rolled toward heaven or fixed upon some indefinite distance, and very often there is a peaceful and heavenly expression.

In diffuse thought and abstraction the attention is centrifugal. In dreamery, reverie, art, Donders and Darwin both find vacant expressions in the eyes. The axes may diverge and are not fixed. Donders found actual divergence in some cases. The physiognomy is often that of enchantment and the expression is more often happy than sad. Sometimes it is not unlike that of sleeping children; so in ecstasy and hallucination. This is often connected with love and monotheism and Buddhism, with synderesis, or unified with the absolute or Nirvana. The expression may be hyperasthenic and the wishing and longing may reach a painful intensity. All ecstasy is immobile and involves suspense and silence. God, says Meister Eckhardt, created the world in order to rest in contemplation. The Italians love to contemplate the actual visual world.

There are, of course, many modifications by race, sex, custom, age, and especially disease. The mimesis of attention in the blind is more fugitive, partial and less energetic than in normal people, and the contraction is often limited to a single group of muscles. The facial movements of the blind when reading aloud by touch are usually motor accompaniments of the oral expression and are weaker when they do not read aloud and vanish in inner attention, *e.g.*, arithmetic. All blind persons, when attentive, are more or less motionless, at least in head and face. In many, spontaneous attention causes tension of the muscles in the back of the neck which become stiff. The difference between those born blind and those who become blind later is that in the former the contraction of the muscles of the forehead and the orbiculares palpebrarum in commando exercises is very difficult, and those of the superciliary muscles are impossible, but by those blinded late in life the isolated contraction of the frontalis and orbiculares is still possible, though it be often weak and sometimes that of the superciliary muscles may be possible even by itself alone. In anger and pain, all blind persons contract their tension muscles, but less than do normal persons.

The intellectual expression of thought, then, by adults is chiefly in the mimic eye zone and in its three dermal muscles. The latter have manifold phylogenetic and ontogenetic functions besides the expression of thought, but the superciliary is most set apart for this latter purpose. Duchenne thought that the frontalis was for attention, the orbicularis and the superciliary muscles for reflection. Most essential are the superciliary muscles which are completely expressive, though not exclusively devoted to attention. They are developed in animals and children to protect from light and are tense in heat, short-sightedness, anger, sadness, etc. Thus the original purpose of the ciliary muscle is to protect the eye. The superciliary muscle, therefore, has three functions. Its highest may be alone and independent of the other functions and other muscles. It makes the vertical furrows on the forehead. Charles Bell thought animals lacked it. How could its pain function be transmuted into thought. Darwin connected it with the child's cry, frowning being its last trace. It narrows and sharpens the field of vision according to his principle of the association of purposive habits. This resembles Wundt's or Piderit's association of analogous adjustment of sensations. "The muscular movements of expression relate to imaginary sense expressions." Thinking always causes effort, if not pain. It is the expression of the psychic. Thus the pessimist has some basis, if thought is pain. Thus to adjust the eye to light in the child is the basis of thought expression in the adult. Sensorial optical attention is its genetic foreschool. Some psychologists think attention is always moving; others that it is fixed, but both theories are needed. In even the best of us, attention and thought are not entirely free from emotion. Thus movement and inhibition act and react upon each other, but while there must be tension there must also be rest and silence. In thought, respiration and vasomotor activities diminish; the muscles are a little relaxed; the pupils widen; blood pressure changes. In general, mental work is thus very different from physical.

Physiology of the Nervous System, by J. P. MORAT. Authorized English edition translated and edited by H. W. Syers. 263 illustrations. W. T. Keener & Co., Chicago, 1906. pp. 680.

This great work is a part of the more comprehensive treatise on physiology by Morat and Doyon. The author premises that it is the nervous system which decides at what moment the energy accumulated by the living being shall be liberated, that is, shall leave matter